



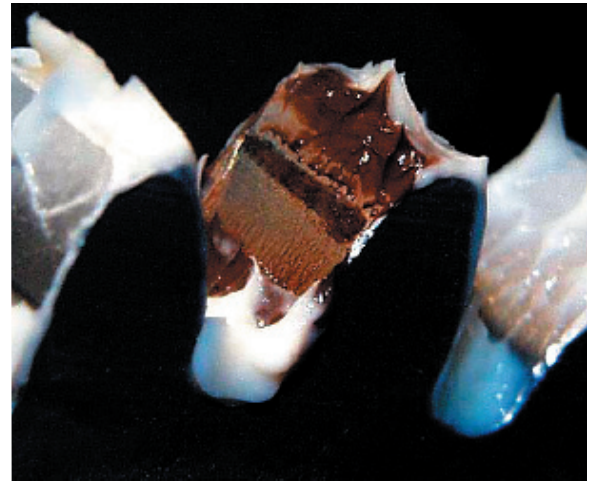
Return To Flight

Shuttle Actuators

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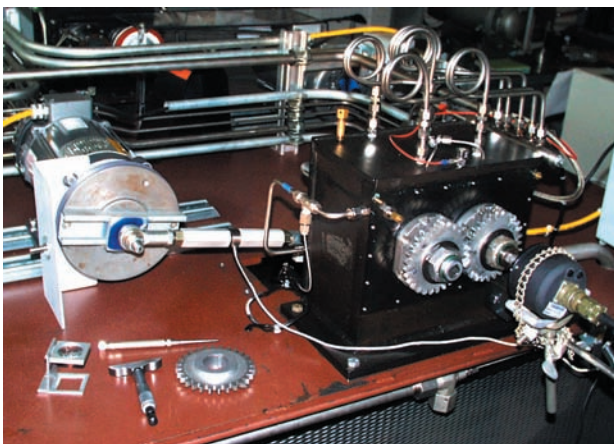
The NASA Glenn Research Center (GRC) Shuttle Actuators Investigation Team continues to play an important role in understanding and resolving the mechanical component and lubrication issues found in the Space Shuttle actuators. The GRC team conducted critical tests on the grease from the actuators and is currently assessing the damage tolerance of the actuator gears.

Upon disassembly of the rudder/speed brake actuators from the Space Shuttle Discovery, the grease lubricant was found to be badly discolored and apparently contaminated. In addition, a number of the actuator gears had wear and fretting damage on the tooth surfaces that could lead to fatigue cracks. In addition, some of the bearings from the body flap actuators showed severe surface degradation.



GRC test gears showing some wear and fretting damage.

The GRC team of experts conducted a number of tests to determine the state of the grease from the disassembled Shuttle actuators after 20 years of service. The team was able to determine that no appreciable degradation of the grease or base oil was apparent even after 20 years of service. In addition, after careful analysis of a badly discolored body flap bearing, the GRC team determined that the bearing had undergone severe chemical degradation of the grain boundaries in one of the bearing balls. The gear tooth damage was determined to be a probabilistic phenomenon that requires experimental data to evaluate any potential added risk. The GRC gear research that is currently underway is a key element of the NASA Engineering Safety Center's plan to address and resolve critical shuttle actuator gear wear and fretting issues.



GRC gear test facility configured to simulate shuttle actuator dither fatigue phenomenon.

The GRC team is currently performing a variety of gear tests to determine the nature of the wear and fretting damage and its effect on gear tooth strength and damage tolerance. Concurrently with the experimental work, probabilistic analysis is being conducted to determine the life and reliability of the actuator for its mission operating profile.

The GRC team's assessment of lubricant and bearing degradation, gear wear and gear fretting, and probabilistic systems analysis of the Space Shuttle actuators are an important element in NASA's effort of reducing risk in the first year returning the Shuttle to flight.